

OXC-1765
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June 6, 1961

Dear Don:

Enclosed herewith is our Proposal 2729, including statements of work, delivery information, cost breakdowns and terms and conditions, in response to your letter of 28 April 1961. You will note that it is really three proposals:

- (1) Proposal 1 is for a Time and Material program to develop a vacuum seal for a circular window configuration, which employs glass provided by Proposal 2. This proposal is subdivided into several tasks, any or all of which could be undertaken (simultaneously or consecutively) depending on the rate of effort you care to support and your schedule commitments.

The successful method developed in Proposal 1 will then be used on the glass resulting from the procurement under Proposal 2. The sealing of units with manufactured glass is included in Proposal 1. This effort is quoted on a budget basis, and assumes that only Task A would be undertaken. Since there are so many variables, firm prices and terms and conditions will be furnished after we have had a chance to discuss this proposal with you.

- (2) Proposal 2 is for a Fixed Price program to manufacture glass for deliverable vacuum-sealed window configurations. It does not include test glass for Proposal 1, but does include such spare pieces as we customarily allow for manufacturing breakage. This glass differs from that of Proposal 3 in that it would be dimensioned and manufactured so as to permit use of a larger variety of possible vacuum seals.
- (3) Proposal 3 is for a Fixed Price program to manufacture glass exactly as specified in your drawing AX-29 (4-22-61). If you are unable to accept our first two proposals, we trust that this third proposal will permit you to select our Corporation to provide finished windows for your own or otherwise subcontracted sealing attempts.

These proposals include only such engineering and manufacturing efforts as are required to produce optical elements and opto-mechanical assemblies with the specified room temperature properties. It is our understanding that Engineering efforts to attempt to control the wavefront deformation of transmitted light are not to be included. These deformations are those "ripples", "bumps", "spikes", "waves", and/or similar departures

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from flatness of the optical wavefront as caused by the glass itself and/or the thermal gradients in the glass (in turn caused by the vacuum seal or edge mounting). Control of the deviation of the average wavefront, as caused by wedge of the glass elements, however, is understood to be our responsibility.

Although we do not know what, if any, operational performance your Customer requires you to provide with the Type III system, we believe that we do know its approximate ultimate performance limit (since this is almost entirely a lens-film limited system). Therefore we have attempted to estimate the influence upon this ultimate performance of deformed (non-flat) optical wavefronts for varying amounts of deformation (as calculated with a simple model). The approximate transfer functions for four wavefront deformations are shown in Figure 1 (attached). In Figure 2, the estimated transfer function for the Type III system is shown, as are three other transfer functions (corresponding roughly to $\lambda/10$, $\lambda/6$, and $\lambda/4$ peak-to-peak total wavefront deformation); and these transfer curves are also shown combined with the Type III system transfer curve. The effect of these wavefront deformations upon the system's operational performance is shown in Figure 3. Whether the kind of wavefront deformation actually encountered will conform to the simple model used in these calculations is, of course, uncertain, but (for what it is worth) we are using these same assumed models in calculating tolerances for the Type I system. Furthermore, whether the estimated effect of these deformations (as shown in Figure 3) is important to you is unknown.

However, if operational performance is an important ingredient of your development of the Type III system, then we recommend that you consider carefully, if you have not done so, the extent to which you can permit a window configuration to deform the wavefront's flatness. Although your window specifications in drawing AX-29 are sensible manufacturing specifications, they do not assure any particularly small departure from flatness to a transmitted wavefront and, therefore, may or may not cause substantial performance degradation. (The specifications of AX-29 do assure that the two glass pieces will produce a total deformation less than $\lambda/2$ due to surface flatness.)

Similarly, the lack of specification on the edge seal and mount may result in troublesome thermally induced wavefront deformations. While we are both very anxious to service your window requirement and to provide you with an informative technical proposal to permit you to evaluate our offered services, the engineering efforts required to devise wavefront deformation controls necessarily is in the category of a study program and not a technical proposal. We are not proposing to undertake such a study now, since the requirement for it is not yet known. On the other hand, if you do choose to accept our offered services as

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described in the attached proposals, we want you to realize (1) that the effect on system performance of wavefront deformation may be serious and (2) that we are not proposing to attempt to control these deformations beyond such manufacturing specifications as quoted.

We suggest that you consider accepting our Proposal 2 at this time, but defer any action on seal procurement until such time as the Type I sealing program is successfully concluded. By so doing, you will decrease the lead time for eventual delivery, and obtain the full benefit of the major developments on the Type I program.

I certainly hope all of these considerations do not sound overwhelming nor appear to be contractual hedging. We are only trying to be informative, and would be delighted either to discuss any of these points with you or to modify the scope of our present proposals if you so desire. We remain anxious to service your window requirements and hope you will find our proposals to be satisfactory.

Best regards

Milt

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attach:

cc: E.F.M.
E.P.K.(w/o Proposal) ✓
L.E.W. (" ")
C.M.H.
File